

Remarks

In this Office Action, Claims 1-9 and 24-25 stand rejected under 35 U.S.C. § 103 as being unpatentable over Sukharev et al. (U.S. Patent No. 6,777,807; hereinafter “*Sukharev*”) in light of Shanmugasundram et al. (U.S. Publication 2006/0003570 A1; hereinafter “*Shanmugasundram*”). Thus, Claims 1-9 and 24-25 currently are pending.

For the reasons set forth below, Applicants respectfully traverse said rejections.

Claim Amendments

As a preliminary matter, Claims 1, 6, and 24 have been amended to improve the clarity of the claims without modifying their scope and without introducing new matter.

Claim Rejections under 35 U.S.C. § 103: Sukharev and Shanmugasundram

Claims 1-9 and 24-25 stand rejected as being unpatentable over *Sukharev* in light of *Shanmugasundram*. Applicants respectfully traverse the rejections and request reconsideration of the rejections in light of the following reasons.

Independent Claim 1, as amended, recites a method comprising:

providing a wafer comprising a plurality of copper structures partially encased in a hydrophobic interlayer dielectric layer, wherein top surfaces of the copper structures are exposed and substantially co-planar with a top surface of the hydrophobic interlayer dielectric layer; and

selectively depositing a cobalt capping layer on the top surfaces of the plurality of copper structures with substantially no deposition of the cobalt on the top surface of the hydrophobic interlayer dielectric layer, using an aqueous electro-less bath; and

applying sonic energy to the aqueous electro-less bath during said selective deposition.

See Claim 1, as amended. Thus, the claimed method comprises, among other things, applying sonic energy to the aqueous electro-less bath during selective

deposition of the cobalt capping layer. As described in the specification, applying sonic energy to the aqueous electro-less bath may cause “substantially less, or possibly no deposition of cobalt **134** on the top surface of the interlayer dielectric layer **130** may be effectuated.” See Specification, page 6, lines 21-23.

Sukharev discloses forming a copper layer over a dielectric layer. However, *Sukharev* fails to teach or suggest applying sonic energy to the aqueous electro-less bath during selective deposition of the cobalt capping layer.

Shanmugasundram fails to remedy *Sukharev*’s deficiency.

Shanmugasundram discloses various cleaning methods for cleaning a substrate prior to and/or after electro-less deposition of a capping layer. See, e.g., *Shanmugasundram*, Abstract; Fig. 4, steps 52, 53, 55, 57, 58; Fig. 5, steps 52, 53, 58; para. 13 (summarizing the invention); para. 34 (referring to step 52 pre-deposition cleaning); para. 38 (referring to step 53 pre-deposition cleaning); para. 42 (referring to step 55 pre-deposition cleaning); para. 48 (referring to step 57 post-deposition cleaning). However, as with *Sukharev*, nowhere does *Shanmugasundram* teach or suggest applying sonic energy to the aqueous electro-less bath during selective deposition of the cobalt capping layer. Thus, *Sukharev* and *Shanmugasundram* combined do not teach or suggest all the limitations of Claim 1.

Therefore, for at least these reasons, independent Claim 1 is patentable over *Sukharev* and *Shanmugasundram*.

Similarly, with respect to independent Claim 24, said claim recites a method comprising, among other things, reducing surface tension of the aqueous electro-less bath during deposition of the cobalt capping layer to increase wettability of the top surfaces of the plurality of copper structures. However, neither *Sukharev* nor *Shanmugasundram*, whether alone or combined, teach or suggest said limitation of Claim 24. Thus, for at least these reasons, independent Claim 24 also is patentable over *Sukharev* and *Shanmugasundram*.

Claims 2-5 and 24 each depend from one of independent Claims 1 or 6 incorporating the limitations contained therein. Thus, for at least the same reasons

stated above, Claims 2-5 and 24 also are patentable over *Sukharev* and *Shanmugasundram*.

Furthermore, with respect to the rejections of independent Claims 1, 6, and 24, *Sukharev* in fact teaches away from combining its teachings with the teachings of *Shanmugasundram*. *Sukharev* states:

[T]he capping layer 20 is formed only over the copper layer 16 and not over any of the dielectric structures 14 . . .
Because the capping layer 20 is not at any time formed over any of the dielectric structures 14, it does not need to be removed in any way from the upper level 18 of the dielectric structures 14.

See *Sukharev*, para. 4, lines 28-35 (emphasis added). Thus, with respect to Claim 1 and 6, even if one could read *Shanmugasundram* as teaching or disclosing preventing or removing any residual capping layer material present on the dielectric layer by applying sonic energy, one would not have motivation to combine to teachings of *Sukharev* with *Shanmugasundram* because *Sukharev* expressly teaches away from such a combination.

Similarly, with respect to Claim 24, even if one could read *Shanmugasundram* as teaching or disclosing reducing surface tension of the aqueous electro-less bath during deposition of the cobalt capping layer to prevent any residual capping layer material from forming on the dielectric layer, one would not have motivation to combine to teachings of *Sukharev* with *Shanmugasundram* because *Sukharev* expressly teaches away from such a combination.

Therefore, for at least these reasons, independent Claims 1, 6, and 24 are patentable over *Sukharev* and *Shanmugasundram*.

Claims 2-5, 7-9, and 24 each depend from one of independent Claims 1, 6, or 24 incorporating the limitations contained therein. Thus, for at least the same reasons stated above, Claims 2-5, 7-9, and 24 also are patentable over *Sukharev* and *Shanmugasundram*.

Conclusion

In view of the foregoing, Applicants respectfully submit that pending claims are in condition of allowance. Thus, entry of the offered amendments and early issuance of Notice of Allowance is respectfully requested.

The Commissioner is hereby authorized to charge shortages or credit overpayments to Deposit Account No. 500393.

Respectfully submitted,
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Date: 03/31/2006

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